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INDUSTRIAL ARTS
INDEX

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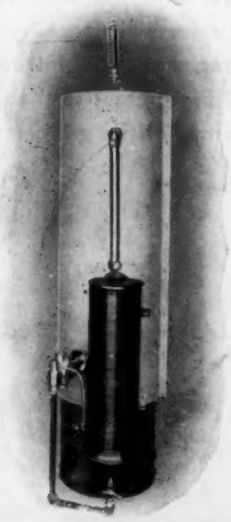

WHEN a traffic cop holds up his hand you stop. Why? There's nothing very awe-inspiring about a man holding up his hand.

But when you put a blue uniform on that man, and a cop's badge, you see behind that cop all the rest of the policemen in town, a summons, a hurry-up wagon, a police court judge, and all the authority of a *whole* city.

When you are arrested by the name Goodman Automatic Gas Water Heater, it means nothing very much — only another automatic water heater, UNLESS you happen to know that Mr. Patrick Goodman has been connected with the gas industry for 28 years, is the inventor of the Goodman Safety Gas Main Stopper, and has backed the Goodman Automatic Gas Water Heater with his name and all the integrity and honesty that the name carries with it to the gas industry.

Then the name Goodman *means* something.

GOODMAN AUTOMATIC WATER HEATER COMPANY, Inc.

523 Atlantic Ave. ***Brooklyn, N. Y.***

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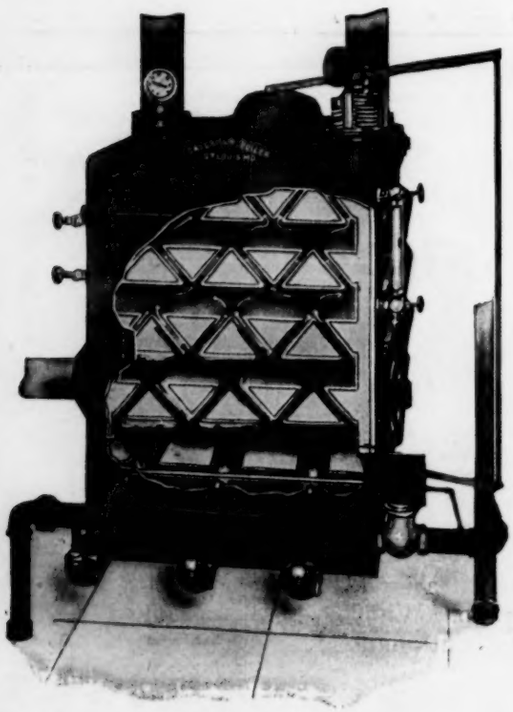
Other Gas Companies Are Doing It!



Send for our booklet and terms and learn how Gallaher Gas-Fired Boilers will increase both Volume Sendout and Profit.

TO educate the masses to the convenience, cleanliness, economy, wastelessness, safety and all the other virtues of house heating by gas, will take time and patience; but if the start is not made the goal will never be reached.

Yet there are some gas companies who have approached the house-heating-by-gas problem in an earnest, systematic manner; notably, The Laclede Gas Light Co. of St. Louis, who have surmounted all of the difficulties and whose efforts have been entirely successful.

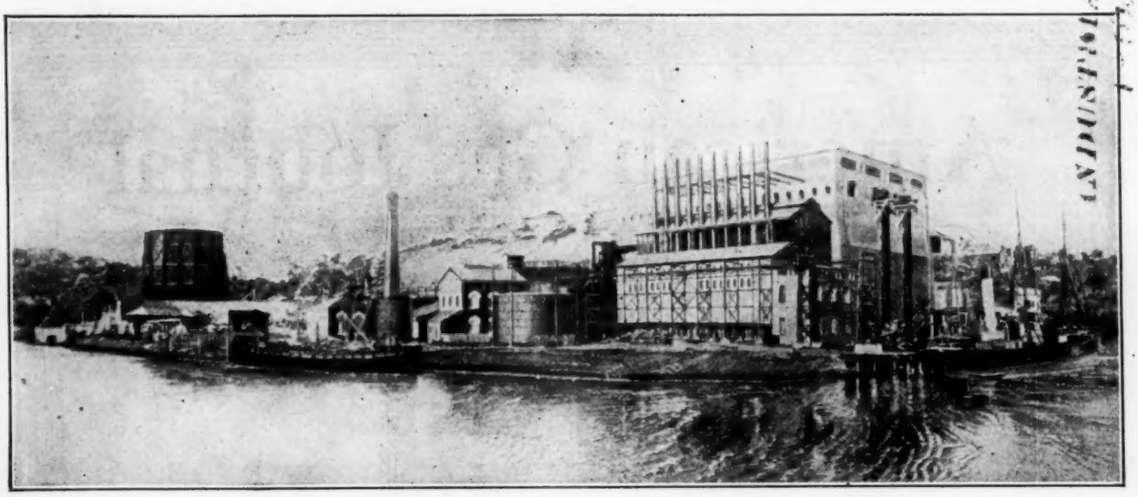
The present time is most propitious for forcibly presenting the advantages of heating by gas, on account of the unsettled conditions in the coal industry with the possible shortage of this fuel next winter, and householders are therefore in a more receptive mood for improved gas appliances, such as the Gallaher Boiler and Storage Tank Heater.

GALLAHER GAS-FIRED TUBULAR BOILERS for Hot Water, Vapor and Steam Heating when shown, lower the sales resistance to this type of house heating and make easy the introduction of gas into a new realm of usefulness; to the satisfaction of the customer and profit of the gas company.

GALLAHER BOILER CO.

Laclede Gas Building, St. Louis, Mo.

INDUSTRIAL ADVERTISING SECTION



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N. S. W.

Daily Capacity	Three million cu. ft.
Coal Plant	Electric cranes and grabs for discharging steamers; two lines of pivoted-bucket conveyor with coal breakers for conveying and elevating coal and distributing it in the coal store; side-tipping wagons and railways from tunnels in the coal store which are at the level of the coal bunkers above the retort bench.
Coke Plant	Conveyor below the retort bench with elevator to ships transported by telpherage to the store.
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American Gas Journal

SIXTY-FIFTH YEAR

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AMERICAN
GAS JOURNAL

Vol 120. No 13 NEW YORK, MARCH 29, 1924 Whole No. 3455

Conserving the Heat in Coke

A method of dry cooling and utilizing heat to useful purpose

M. C. Sissingh
Rotterdam, Holland

Coke manufacture

(The dry cooling of coke and the saving of the heat that is contained in the incandescent mass and its utilization to good purpose in the production of steam, etc., is a subject of considerable interest. There is of course a great deal of heat in the incandescent coke that is discharged from the gas retort. This heat is generally allowed to go to waste by spraying the coke with water and allowing it to cool off in the open air. That this heat could be used to good advantage goes without saying and requires no discussion. That not much progress has been made in this country towards utilizing this waste heat is due to the fact that fuel conditions have not made it advisable or expedient to save this heat. In European countries, where the fuel problems are much different than they are in this country, steps have been taken to save the waste heat in the coke and apply it to useful purpose. The present article, which was originally published in the Dutch gas journal, known as Het Gas, and which was translated into German and printed in Das Gas und Wasserfach, gives the practical results of the dry cooling of coke and utilization of the heat gained in this way in the Rotterdam gas works. It is an article that is worth while reading, for it shows how great a saving can be gained by this practice.—Editor.)

The gas works of Rotterdam consist of a horizontal retort installation of ten retorts to each chamber. There are four chambers. Each has a coal capacity of 4.25 tons of coal. The coke cooling installation which is used is patented as the Sulzer system. The coal is gasified within a period of twenty-four hours, so that it is necessary to discharge the hot mass of coke once every twenty-four hours, and cool it off so that it can be shipped away. The working day at the plant is sixteen hours. No work is done during the night except to watch the retorts and fill the producers.

The Old Method of Operation

In the old method of operation the glowing contents of the chambers were discharged into an iron wagon which was run on to a hoist and the coke was quenched by allowing the wagon to pass through a hole filled with cold water. Then the container with its quenched coke content was lifted out of the pit and discharged into a special bin for storing the coke. This method possessed one serious disadvantage, and that was that in order to make sure that no hot or incandescent coke particles were still in the container, after it left the pit, and hence make it possible for the same to set fire to the storage bin, it was necessary to allow the coke to remain in contact with the water for quite a prolonged period of time and the result was that the coke absorbed a considerable amount of the water. Likewise as in the other methods of quenching coke in which a comparatively large volume of water is employed, rather a considerable proportion of coke breeze was formed.

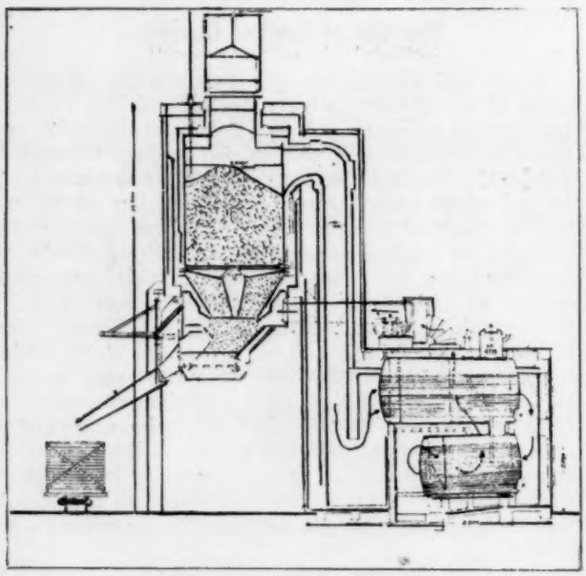
The New Dry Cooling Method

In adopting the new dry cooling method a good part of the apparatus used in wet method was retained. The coke is carried to the dry cooling installation in small trucks or wagons running on rails. The coke cooler is made of concrete and iron and is provided with a firebrick lining on the inside. The charging opening is at the top and this is made in the form of a double hopper. The top is shaped like a bell and dips into a water trough, making a hydraulic joint. The lower opening of the hopper is made in the usual manner and is closed by a trap. As

soon as the wagon or truck load of coke comes to a standstill after being pulled up to the level of the charging device, the bell or hood automatically lifts and exposes an opening into which the coke is discharged. The incandescent coke is dumped into the cooler and then the bell hood automatically closes again. The empty truck slides down the runway and comes to a stop under the opening at the bottom of the apparatus, through which the cooled coke is discharged. The trap closing the opening is lifted and the cooled coke is fed out of the apparatus by means of a device which is operated by the aid of an electric motor. As soon as the truck is filled, the motor is shut off, the trap closes and the truck, filled with cooled coke, proceeds on the tramway to the bins in which the coke is stored.

How the Coke Is Cooled

The cooling of the coke is accomplished by circulating flue gases around and through the cooling apparatus. These gases are blown in under the bed of coke by means of fans, rise through the same and extract the heat from the hot coke. The hot gases then leave the apparatus through an opening at the top, pass down a pipe and through the tubular system of a boiler. There they give up their heat to the water in the boiler and are again blown through the coke bed by the fan. The result is that the greater part of the heat in the coke is recovered and applied to useful purpose in the generation of steam. Two men tend the entire installation.



Arrangement of Apparatus

Efficiency of the Cooling Installation

It was deemed advisable to make an investigation of the efficiency with which this cooling installation operated. To do this, a series of observations were made covering a period of twenty-four hours. These observations included a sixteen-hour period during which the retorts were charged and discharged and the coke was cooled in the cooler and another eight-hour period, during which just the coke that was still in the cooler was further cooled. The temperature of the eternal air was 4 degrees C. The number of retorts which discharged into the cooler was twenty-four. The total mass of the gasified coal was weighed and found to be 92.4 tons. The quantity of coal in one retort and the quantity of coke that was obtained therefrom in the dry condition were weighed.

The results showed that the yield of coke was 70 per cent of the weight of the original coal. The same yield was then assumed to be obtained from the rest of the coal, with the result that 92.4 tons of coal were calculated to produce 64.6 tons of coke. In dumping the trucks in which the coke was transported from the chambers to the cooling installation, a certain amount of coke was retained, and this was found to be 0.117 ton. This quantity of coke was quenched with water and hence had to be deducted from the total amount dumped out of the retort. Hence, the cooler received and cooled only 61.8 tons of coke.

Determination of Temperature

The temperature of the hot coke was determined by means of a radiation pyrometer in seventeen of the retorts. The average temperature was accordingly found to be 1031 degrees C. Then, again, the temperature in five of the retorts was established by means of a special calorimeter-pyrometer which was devised for this special purpose. The calorimeter consisted of an iron vessel, which was well insulated with mineral wool and was contained in a wooden box, whose dimensions were 75 by 50 by 50 centimeters. The temperature readings were made with the aid of a Beckmann thermometer which possessed an accuracy of one one-hundredth of a degree C. This determination yielded an average temperature of 1087 degrees C. Then, again, the temperature in the same five retorts was determined by the aid of a Haas pyrometer and found to be 1026 degrees C on an average; hence 61 degrees C lower than the former result.

Results Obtained With Calorimeter More Accurate

The conclusion was reached, after due deliberation, that the results obtained with the calorimeter was more accurate and that the direct temperature determined yielded results that were too low. The average temperature of the coke was accordingly established from the average direct temperature measurements, which were made with the aid of the Haas pyrometer, and the difference of 61 degrees C was added thereto. The final temperature reading was, therefore, fixed as 1031 plus 61, or 1092 degrees C., this figure being used in the calculations.

The temperature of the cooled coke was deter-

mined by means of the afore-described calorimeter and established to be 212 degrees C. on the average. In determining the amount of heat that is contained in the coke at the high temperature and the amount that is released by the coke in cooling off, the average specific heat of coke was taken to be 0.365 between 1092 and 21 degrees C., and 0.202 between 212 and 21 degrees C.

Heat Released in Cooling of Coke

In cooling 61.8 tons of coke from a temperature of 1092 degrees C. to 212 degrees C., the following quantity of heat, figured in calories, is set free; 61.8×10^3 ($1092 \times 0.365 - 212 \times 0.202$) or a total of 2177×10^3 calories. From each ton of coke there are, accordingly, obtained 352×10^3 calories. This heat is utilized under the boiler, with the result that 28.81 cubic meters of water are changed into steam at a pressure of 9.8 atmospheres. The temperature of the feed water was 57 degrees C. The amount of heat that is required for this purpose is $2881 \times 606 \times 10^3$ or $17{,}459 \times 10^3$ calories. The efficiency of the cooling installation was therefore found to be 80.2 per cent ($\frac{17459 \times 10^3}{21770 \times 10^3} \times 100$). In other words, of the 352×10^3 calories that are set free from one ton of hot coke, 282×10^3 or 80 per cent are utilized to useful purpose. If the calorific value of one ton of coke is taken to be 6500×10^3 calories, then there is a recovery of 4.3 per cent of heat on this basis. This refers to the total amount of coke produced from the retorts.

Practical Observations on Operation of Installation

A practical test was made on the operation of the cooling installation, which included making a large number of gas analyses and temperature determinations in order clearly to ascertain what was going on in the circulation of the flue gas from the cooling chamber to the boilers and back again. One of the first things that had to be fixed was the leakage of air into the apparatus. Almost at every point in the installation there was an excess pressure on the inside. Only in back of the pump was the pressure within the apparatus less than atmospheric.

The reduction in the content of carbon dioxide in the gases was established when the fan was running at a normal speed and when the temperature of the gases, as they left the cooling chamber, was 220 degrees C. It was found that in a period of 2.5 hours, the carbon dioxide content of the gases was reduced from 14.9 to 13.3 per cent, or about 0.565 per cent per hour. The volume of the circulating gases was 120 cubic meters.

Loss of Coke in Burning While Cooling

When the temperature of the circulating gases is taken on the average as 400 degrees C, the volume of air increases to 195 cubic meters per hour and contains 0.41 cubic meters of oxygen. This amount of oxygen will burn up 0.22 kilograms of coke and develop in this way 1170 calories of heat. In a total period of 16 hours, the amount of carbon burnt up will be 3.25 kilograms and the quantity of heat that is evolved will be 28,320 calories, which is approximately 0.13 per cent of the total amount of heat that is available each day from the hot coke.

However, there are certain times during the cooling process when the interchange of heat must be greater. Shortly after the time that the hot incandescent coke is filled into the cooling chamber the temperature of the gases rises sharply and thereafter it falls gradually, which results in a contraction of the volume of the gases. The temperature increase, nevertheless, takes place in local spots only. At the entrance to the fan, the temperature is constant and the same is true underneath the container. In the upper portion of the cooling chamber the temperature difference amounts to from 130 to 150 degrees C., but this is due to the radiant heat of the hot coke and hence the temperature difference in the circulating gases is less. In the flue behind the cooling chamber the temperature is 70 degrees C. If the temperature difference for the hot gases is maintained at that point while the temperature of the cooled gases remains constant, then the average temperature difference in the circulating gases throughout the entire apparatus may be taken as 35 degrees C.

Temperature of the Circulating Gases

During the process of cooling the average temperature of the circulating gases in the flue, after leaving the cooling chamber, is 450 degrees C. and when the gases leave the fan their temperature has been reduced to 170 degrees C. This permits the assumption to be made that the average temperature of the gases in the system is 310 degrees C. When the figure 35 degrees C. is used as the over-all temperature difference, then there is a corresponding reduction in volume of 6 per cent ($\frac{35}{601}$) which must be equalized by the entrance of an equivalent amount of air from the outside.

As the total amount of circulating gases is 120 cubic meters, this means a volume reduction of 7.2 cubic meters. But this takes place thirty times in the thirty fillings of the retorts. Hence the total amount of air that is sucked into the installation is 216 cubic meters at a temperature of 310 degrees C., which gives a volume of 101 cubic meters at 0 degrees C. In this amount of air there are 21 cubic meters of oygen, which will be sufficient to burn up 11 kilograms of carbon, which will produce an amount of heat equivalent to 0.25 per cent of the total sensible heat brought into the cooling chamber in the form of hot coke. Furthermore, a certain amount of air is brought into the installation by opening the doors and hoppers for charging and discharging the coke. Just how great this amount of air is cannot be determined without considerable difficulty, but at any rate it cannot be large enough to

(Continued on page 299)

Gas in the Year 2000

A Prognostication into the Future

Edward J. Cooney

Sales Manager, Lowell Gas Light Company, Lowell, Mass.

I REMEMBER so well, in the year 1924, only seventy-six years ago, a man who considered himself a master statistician, made an ill-chosen reference to the fact that gas had seen its best day and was soon to disappear as an economic force.

It was as though a man had been rudely awakened from a slumbering state by blasts of wind from an unexpected source.

"Babson's Blast"

"Babson's Blast," as it was aptly termed, awakened a slumbering gas sense among men who were connected with the gas industry, but who were remaining peacefully quiescent, while that great force, electricity, was slowly but surely gobbling up the power and light business, and was making great inroads into the realms of heat.

Roger Babson, whose body and whose prognostications have long since been recorded as deceased, did the great gas industry a benefit, the full force of which we of this generation are enlarging upon to pass along to posterity.

A few reflections on gas as it was known in 1924 and as it is known in this year of 2000 A. D. will not be amiss.

Cities Lighted With Gas

If old Roger himself were to see the lighting systems of today—Gas—whereby whole cities are made as bright as day—with that glare lacking which caused legislation to be enacted in 1924 that the health of the populace might be conserved—he would be amazed.

It took a great many years for the gas interests to recover from the shock caused when the unknown force that was sent through wires to create light first invaded the field the gas man felt was his by right of heritage.

European countries were the first to study light in its relation to health, and the more deeply they delved into the subject the more surely they convinced themselves and a skeptical world that gas light had health-giving propensities and caused less injury to that greatest of all God-given senses—sight.

But once scientists proved that gas was less harmful to the eyes and health than any other form of artificial lighting, a business that had been losing ground took on a new lease of life, until today we see it the transcendent method of illumination all over the entire universe.

By-Products in Coal No Longer Wasted

An awakened public conscience first put a stop to the barbarous practice of burning raw coal, with the consequent waste of the valuable by-products, such as drugs, fertilizers, tar, carbon bisulphide for dissolving rubber, ammonia, dyes, including indigo, moth balls, photographic chemicals, sulphocyanides, carbon for electric arcs, explosives, perfumes derived from tar, coke, etc.

Today the large gas plants engaged in reclaiming these valuable by-products of coal are mute but magnificent evidence of the lack of wastefulness in these later days.

The fact that our coal mining is all done by machinery today with mines so arranged that loss of life is almost unknown also shows a wonderful step in the march of human progress. Our radio equipped mines that seem so simple today were in 1924 only visionary dreams in the minds of scientists. The work one white uniformed man today controls by the simple turning of a switch took thousands of coal-discolored men to accomplish seventy-five years ago.

Gas Heated Homes

Our gas heated homes of today would be a revelation to the gas men of the earlier period. No more is the air polluted by coal smoke with its attendant destruction of certain forms of animal and plant life. Anthracite coal today is only seen in museums, while the carting of soft coal can only be done on special permit of the Federal government. Where once coal bins took up valuable space in residences, today all that is necessary is the occasional inspection of the thermostatically controlled mechanism that needs no attention from one week end to another.

Far back in 1924 manufacturers and even home owners were convinced by clever salesmen and advertising that oil was an economical fuel. Many thousands of dollars were spent in installation of oil burning apparatus, all of which has long since been discarded, traveling the same route as old newspapers—the junk pile.

Gas is today as indispensable in factory operation as oxygen is to the lungs. Men sitting around the dinner table today refer back in terms of amazement to the fact that men once used coal and oil as sources of heat.

The slogan adopted by the gas man in 1924, "If it's done with heat, you can do it better with gas," was then considered visionary, but today is an actuality that no one tries to dispute.

GAS MERCHANDISING

Domestic – Industrial

Selecting the Best Fuel for Commercial Cooking*

An efficiency engineer helps the hotel, restaurant and club management solve the cooking fuel problem

James W. Cohn

Efficiency Engineer

NOTABLE success in any business organization depends on the manager's ability to procure the right kind of brains. Modern sales organizations are using this principle when they hire technically trained men with sales experience to help solve the problem of the sale of fuel for commercial cooking.

You mak ask, "Why do they not secure men who are especially trained in the sale of hotel and restaurant equipment?" The answer is, the fuel companies have productive hotel and restaurant sales departments, but they are not equipped to give the customer the engineering service.

The importance of the problem may be realized when we consider that 18 per cent of the total receipts from the sale of gas in Chicago is derived from the use of gas for commercial cooking.

The Peoples Gas Light & Coke Company has taken the initiative and created a sales engineering section to act in conjunction with the hotel and restaurant sales department. This new section consists of men who have had technical training with sales experience, and who have been thoroughly trained in hotel and restaurant practice. Special effort was made to get men with creative ability who could analyze new situations.

Essentials of an Ideal Fuel

In discussing the problems involved and possible solutions, we must first establish and agree upon what the essentials of an ideal fuel are.

This is necessary because in most cases, where there is a real or an imaginary point of contention, there is too much irrelevant and digressing discussion.

After taking the matter up with several users of fuel for commercial cooking, the manufacturers of fuel, several manufacturers of fuel burning equipment, and several recognized authorities on kitchen management, we found that the five essentials of an ideal fuel for commercial cooking are:

First—The fuel should be one that will conserve our natural resources.

Second—It should be reliable.

Third—It should be economical.

Fourth—It should be flexible.

Fifth—It should be hygienic.

All the interests agreed upon the five essentials, but there was some disagreement as to the order of their importance.

Gas as a Fuel Will Conserve Our Natural Resources

I suggest that the reader use his own judgment in answering the following question: Which is more logical and conserving of natural resources, to convert the heat energy in coal into steam and that steam through boilers, engines and dynamos into electricity, and then convert that electricity after transmission and by means of cooking equipment, back into heat energy; or take the heat energy quality out of coal, mix it with the heat qualities in oil and deliver it in the form of gas to the consumer, to be converted into heat for cooking when and where he wants it? Our judgment directs us to answer—the latter.

Gas Compared With Electricity

We are agreed that the heat value of one pound of coal is 12,000 B. T. U.

The heat value in one cubic foot of manufactured gas is 525 B. T. U.

One KWH of electricity converted into heat is 3,412 B. T. U.

*Read at the annual meeting of the Illinois Gas Association.

The most efficient steam electric generating plant operated in the city of Chicago, which is incidentally the most efficient in the world, advises us it takes two pounds of coal to generate one KWH of electricity at the buss bar.

We know from our records that two pounds of coal will generate 37 cubic feet of gas. Two pounds of coal equals 24,000 B. T. U.

Two pounds of coal equals 1 KWH of electricity, and is equal to 3,412 B. T. U.

Two pounds of coal, figuring extremely conservatively, equals 37 cubic feet of gas, or 19,425 B. T. U.

Please note that out of the 24,000 B. T. U. in two pounds of coal, less than 15 per cent is available when electricity is used, while more than 80 per cent is available when gas is used.

You mak ask why we do not consider this evident drastic conversion loss when using electricity as light or power. The answer is that the useful work done by one KW (two pounds of coal) for operating motors or for lighting lamps is much greater than when used for heat.

One KW is equal to 1¼ H. P., which will operate five dish washers.

One KW is equal to 1,000 watts and will operate sixteen 60 watt lamps.

One KW is equal to 3,412 B. T. U. and will boil only 1½ quarts of water.

The energy used up in one hotel electric range, that is 22 KW, will operate two elevators (two 15 H. P. motors) or light 716 rooms (716 — 60 watt lamps). In a range for commercial cooking, it does practically nothing.

The only legitimate excuse for the use of electricity for commercial cooking is in places where gas is not available.

The use of coal as a cooking fuel, when considering conservation of resources, need not be considered on account of the necessary large losses in the coal equipment and the consequent low efficiency.

I do not infer that it is impossible to demote gas from its present superiority as a fuel, but in order to do so, it will be necessary to keep the gas industry at a standstill, and at the same time make it possible to get the substitute energy from the sun or some other celestial body.

We cannot help but conclude, if we want to conserve our natural resources, no other fuel but gas should be considered.

Gas Is Most Reliable

The steward of two of our finest hotels advises me that he would not consider a fuel for his kitchen unless it were absolutely reliable, even if he could get it for nothing. When I asked him if he ever had any trouble with gas when he wanted it, he told me that it was dangerous to lose faith in the gas supply, that whenever we open the valve on a burner we can be reasonably certain that gas, rich in heat, is coming out. But I have heard of cases where the proverbial snap of the switch was heard and the expected magic was not performed.

The Electric and Gas Fired Bake Oven

The electrical appliance manufacturer seems to have sold more electrical bake ovens than any other heavy commercial cooking appliances. This may be due to the fact that it has some merits, such as thermostatic control and heat control of the individual baking decks. Realizing these advantages, it is interesting to note that in a short time we will have gas fired baking ovens similarly equipped with thermostatic control. But if we consider the high initial cost of electric bake ovens, the excessive cost of installation, and the exorbitant cost of electricity as compared with gas, more essential merits are necessary to convince the reasoning business men.

An Investigation of Electrical Baking

In places where no fuel cost records are kept, such as in a few of our hotels, we find that the baking load is metered with the power and lighting load. The owner has no cost record at all of the bakery goods. If this type of owner would investigate before recommending his type of installation to prospective buyers, he would most likely find that he is operating his bake shop at a loss, the same as the manufacturer, who made several items, found after installing a cost system that the loss on one item was nearly as much as the profit on two other items.

The investigator would also discover that nothing is baked in the electric bake oven that requires moisture. In some instances bakers, to fill this moisture requirement, go to the extreme of installing steam jets in electric ovens, although gas oven users find that the gas has enough moisture to give the finish required to give the taste appeal to bakery goods.

It might be well for the prospective buyer to know, when looking for a reliable fuel, that the odor from an electric roast oven is sometimes unbearable, due to the oven insulation being saturated with the condensation of previous roasting operations and that the electric broiler for fast, efficient work, is an absolute failure.

Use of Coal for Commercial Cooking

The use of coal in Chicago for commercial cooking is disappearing. I know of only one coal fired cooking installation that is less than ten years old. Those that are in use will soon be ready for replacement, and the coal equipment will be junked.

A gas kitchen is never subject to delay due to the necessity for building or replenishing a fire.

You must also consider the annoying and expensive interruptions in coal supply, that seem to be becoming more and more frequent.

Users of gas appliances can feel assured of an uninterrupted supply of gas at a constant price.

The gas company itself supplies all storage room necessary and does the worrying when coal and oil are scarce.

For every one that will recommend any other type of fuel for reliability, 100,000 will recommend gas.

(Continued on page 292)

INDUSTRIAL GAS LESSONS

IF IT'S DONE WITH HEAT — YOU CAN DO IT BETTER WITH GAS

Lesson No. 13

Measurement of High Temperatures (continued)

Photometer Type of Optical Thermometer

Another form of optical pyrometer measures the light that is emitted by an incandescent body and compares it with the light of a standard candle. The scale on the instrument reads degrees directly. This device works in much the same manner as a photometer, the instrument used for measuring the intensity of light, that is, its candle power. There are various instruments which work on this principle and others that work on a combination of this principle and the variation of the current that takes place when the light from an incandescent electric bulb is brought to the same point of incandescence as the light from the hot body, this current variation being read off a meter whose scale is graduated in degrees.

Heat and Color

It is often necessary for the industrial gas engineer to judge the temperature of a furnace when the necessary temperature measuring instrument is not available. A rather good approximation of the temperature within the furnace can be ascertained by observation of the color of the hot walls of the same. Of course, a certain amount of practice is necessary before results of any degree of accuracy can be obtained, but it is a fact that the furnace man becomes very skilled in this respect and is able to judge the temperature of his furnace quite accurately from the color of the heated walls or of the flame.

There are various tables of colors and their approximate temperatures, and the one that is given below gives as good results as any:

The Color of the Emitted Light and Its Corresponding Temperature

Colors.	Temperature in deg. F.
Red, visible in the dark	752
Red, visible in the twilight	885
Red, visible in the daylight	975
Red, visible in the sunlight	1,077
Dark red	1,292
Dull cherry red	1,472
Cherry red	1,652
Bright cherry red	1,832
Orange red	2,012
Orange yellow	2,192
Yellow white	2,372
White, welding heat	2,552
Brilliant white	2,732
Dazzling white (bluish white)	2,912

Calorimetric Pyrometers

In this form of pyrometer the heated body is immersed in a mass of water and the temperature to which the large (comparatively so) body of water is raised by the quenching of the heated substance is measured with an accurate thermometer and the observed temperature is employed in a formula for calculating the temperature that the hot body must have possessed to produce such a rise in temperature in the mass of water. The instrument that is employed for this purpose is simple enough to use, but it does not possess any great degree of accuracy. All in all, this method of measuring high temperature is not of any particular importance.

High Temperature Determination by the Fusion Point Method

A rather common and convenient method of determining high temperatures is by the fusion point of certain substances which are introduced into the furnace, flue or muffle.

Seger cones are used for this purpose, particularly in the clay and ceramic industries. The cones are really small pyramids made of a mixture of quartz, kaolin, marble and fluorspar. The proportions are adjusted so that a series of cones is obtained with different melting points, each a definite number of degrees higher than the next lower in the series. The melting points of these cones are known and by observing which of the series melt in the furnace it is possible to obtain a fairly accurate idea of the temperature of the same.

Special alloys are also used in this method of high temperature measurement. These alloys are usually made from gold, silver and platinum.

Miscellaneous Types of Pyrometers

The remaining types of pyrometers are not of any great practical importance, but some of them may be

used under certain special conditions. Thus there is the water pyrometer, which depends on the increase in temperature of a stream of water flowing at a given rate through a tube inserted in the heated chamber. In some forms of optical pyrometers the light from the heated body is polarized and measured in this form. Wedgewood's pyrometer depends on the diminution of the volume of a clay cylinder. The expansion of metal rods and graphite has also been used as the basis of high temperature measurement. In another form of pyrometer the hot air from the furnace, etc., has been diluted with a known amount of cold air and the temperature of the mixture determined and calculated back to the temperature of the original hot air.

SELECTING THE BEST FUEL FOR COMMERCIAL COOKING

(Continued from page 290)

If judgment of numbers is any criterion, you will agree with me that gas is most reliable, as a fuel for commercial cooking.

Unquestionably the Most Economical

Economics have taught us that an ideal transaction is one in which all parties concerned have profited. Let us consider the cheapest rate the electrical interests can give the consumer and still make a profit.

At the most efficient plant, two pounds of coal will develop 1 KWH of electric energy.

It is generally conceded that the cost of fuel is only 15 per cent of the sale price of the delivered energy.

The average cost of coal to this most efficient plant is $4 per ton. Then $\frac{2}{2000} \times 400 \times \frac{100}{15} = 2.6$ cents per K. W. H.

It is plain to see that the attractive rate now being offered as bait to large users would be impossible if electricity should come into general use as a cooking fuel.

Use of Water-Power Electricity

What if water power is used? I have heard asked. If only 15 per cent of the sale price of power can be charged to coal, and the initial cost of a hydroelectric plant is so much greater than a steam plant, we can see that there would be very little saved by using water power, so that even if electricity were produced from the air, unless it could be done economically, it could not replace gas as a fuel.

The real cost of a fuel is the cost per B. T. U. delivered.

Comparative Energy for One Dollar

The average cost per KW to large users of electric energy is 2 cents per KWH.

The average cost to large gas users is 80 cents per thousand cubic feet.

Let us figure the amount of energy received in each case for $1.

In electric energy $1 will buy 50 KWH, or 50 times 3,412, which equals 170,600 B. T. U.

In gas heat, $1 will buy $\frac{001}{80} \times 1000 = 12{,}500$ cu. ft.

As each cubic foot of gas contains 525 B. T. U. it follows $12{,}500 \times 525 = 712{,}500$ B. T. U.

That is the cost of electric energy, when used as heat is equal to $\frac{712{,}500}{170{,}600}$ or more than four times as great.

It is evident that gas burning equipment can afford to be one-fourth as efficient as electrical equipment and still leave the fuel cost the same, while the electrical interests in their wildest hallucination, have claimed a difference in efficiency of only 40 per cent.

Initial Investment and Upkeep

Let us consider the comparative initial investment and upkeep necessary for equipment.

One section modern gas hotel range costs about $150.

One section electric hotel range costs about $700.

Maintenance cost on modern gas ranges is about $2 per year per section.

Maintenance cost on electric ranges for approximately the same work is about $60 per year per section.

The cost of installation of gas ranges is no more than the cost of installation of electric ranges, where both gas and electricity are available.

A modern gas bake oven of the same capacity as a 25 KW will cost $690.

A 25 KW electric bake oven costs $1,560.

The Economy of Coal as a Fuel

In considering coal as a cooking fuel, with reference to economy in comparison with gas, we do not claim any saving in fuel cost. Usually the coal cost is 25 per cent lower than gas.

We often show an actual saving, however, when the labor of the fireman is accounted for, as well as other items ordinarily omitted from consideration.

When work is intermittent a gas range can be operated for less money than a coal range, fuel cost only being considered. This is due to the convenience for turning off the gas immediately when there is no further use for it, and then starting it quickly upon need for heat again.

Danger of Inefficient Gas Burners

Inefficient gas burning equipment is the cause of much trouble in the sale of gas for commercial cooking. One type of inefficient equipment is the gas-fired coal equipment, that is, equipment originally designed to burn coal, converted into gas equipment by inserting gas burners.

(Continued on page 300)

As The Journal Views It

THE SERVICE CHARGE

It is a truism to say that probably the most important probelm facing the gas industry today is the rate making problem. There is nothing so basic, there is nothing so fraught with possible effect on the prosperity and welfare of the gas industry than the establishing and maintenance of properly constructed rate structure. Furthermore, it is of equal importance that the rate structure is adopted and applied in determining what the consumer should pay for his gas should be acceptable to the gas customer, not merely because he is told that it is proper, but because he himself actually understands and feels that the rate is equitable from all standpoints.

In explaining rate structure to the consumer, there is perhaps no more difficult detail to make understandable to him than the matter of the service charge. Of course it is presupposed that a scientific rate structure will contain such a charge, and it is now generally held that such a charge is a proper constituent of the gas rate.

Just why this should be so difficult a matter is sometimes hard to say, for if any one would stop for a moment to study the situation, he would clearly see that, no matter what he buys, by far the greater proportion of the expense that he incurs is paid to compensate for service. It is not the cost of the material that is important, but the cost of labor, or transportation, of selling, and of rendering service, so that the article may be made available to him, that make up by far the greater proportion of the selling price of merchandise.

What is necessary is to educate the customer to consider gas in the same light as he does other articles that he buys, and for which he does not hesitate an instant in paying for service. He knows that if he buys an article in the department store and it is delivered to him in a delivery wagon that he is paying for the cost of delivery in the purchase price of the article, and he should be made to understand that there are similar costs involved in serving him wtih gas, and that it is only simple justice that he should pay for service.

Furthermore, he must be made to see that when he pays a service charge, distinctly separated from other costs in the gas rate, this procedure is of decided advantage to him, for it spreads the cost of service over every consumer instead of limiting it to merely those who actually use sufficient gas to make them profitable customers to the gas company.

A New England gas company, in describing a change of rates involving the service charge, explains to its customers in the following terms the reasons why such a rate is to the best advantage of all concerned:

A careful investigation has shown that the old method of charging for gas makes a majority of our customers pay more than their share of certain costs, and allows the minority of customers to pay little or nothing towards the cost of doing business.

There are certain costs common to all users which should be shared alike. These costs and expenses are the same whether the customer uses gas in large quantities or no gas at all.

The company furnishes a service pipe and meter, stands interest, depreciation, and taxes on them, pays the expense of maintaining and repairing the service pipe and meter, of moving the meter from house to house, and of reading the meter.

Meter readings must be entered on the books, monthly bills made out and delivered to customers, amounts collected, stationery and supplies used, all other office expenses paid, and every part of the foregoing work supervised.

Under the old rates, when any consumer in whose interest these expenses are incurred does not use sufficient gas to pay his share, he makes the other

GAS WRINKLES

Apparatus for Testing Meters for Leaks

W. G. Allen

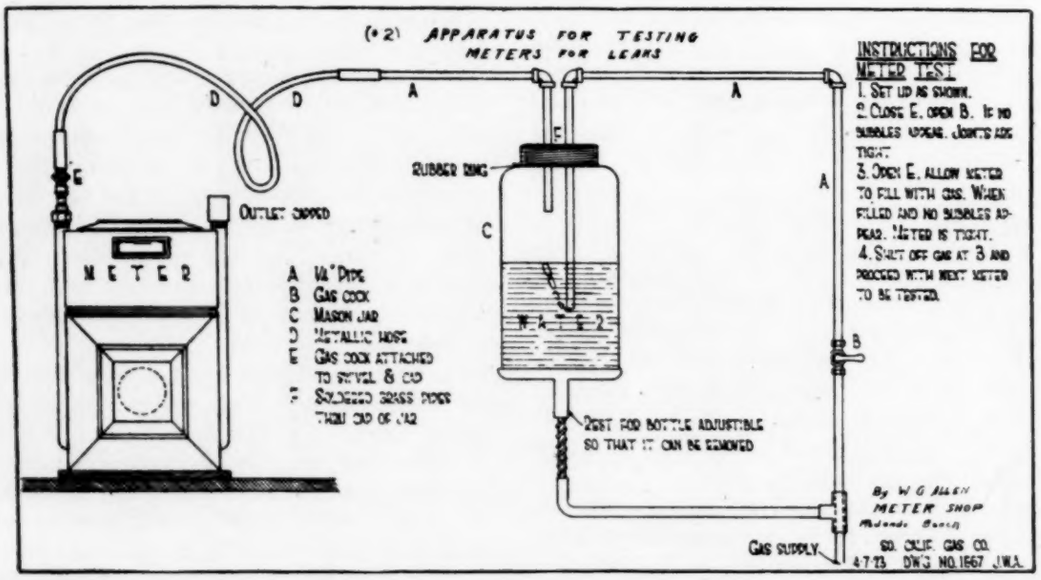
Redondo Beach, California

This apparatus can easily be constructed with material procurable around the meter shop and is one of the most sensitive and accurate means of testing meters for leaks. It is very simple and consists of the following parts:

(A) ¼-inch Pipe.
(B) Gas Cock.
(C) Mason Jar.
(D) Metallic Hose.
(E) Gas Cock attached to swivel and cap.
(F) ⅛-inch Brass Tubing.

The brass tubing is soldered into the top of a mason jar, allowing one piece to extend below water level in the jar. The other piece is flush with the top. The mason jar should be filled half full of water and the top screwed down tight, using a rubber ring to make it air tight. Connect up as shown in the drawing below, care being taken to have all connections air tight. The outlet of the meter should be capped.

It is apparent that unless the meter is gas tight there will be a small quantity of gas passing through the pipe, A, the mason jar and the tubing D, which will be detected by the bubbles in the water which the jar contains.


(#2) APPARATUS FOR TESTING METERS FOR LEAKS
INSTRUCTIONS FOR METER TEST
1. SET UP AS SHOWN.
2. CLOSE E. OPEN B. IF NO BUBBLES APPEAR, JOINTS ARE TIGHT.
3. OPEN E. ALLOW METER TO FILL WITH GAS. WHEN FILLED AND NO BUBBLES APPEAR, METER IS TIGHT.
4. SHUT OFF GAS AT B AND PROCEED WITH NEXT METER TO BE TESTED.
D
A
RUBBER RING
OUTLET CAPPED
METER
C
A ¼" PIPE
B GAS COCK
C MASON JAR
D METALLIC HOSE
E GAS COCK ATTACHED TO SWIVEL & CAP
F SOLDERED BRASS PIPES THRU CAP OF JAR
REST FOR BOTTLE ADJUSTABLE SO THAT IT CAN BE REMOVED
GAS SUPPLY
By W G ALLEN METER SHOP Redondo Beach
SO. CALIF. GAS CO. 4-7-13 DWG NO. 1667 J.W.A.

consumer who does use more gas pay more than his share, thus resulting in discrimination.

We are therefore seeking to distribute these expenses equally among all of our customers so that each one will pay as nearly as possible the actual expense he causes the company.

The small consumer is not necessarily a poor man. The small consumer is found among the wealthy, among the theaters, the public buildings, the stores, and business places where gas is installed as an auxiliary system to be used only in case of emergency.

If there are many consumers who do not pay the cost of service, the balance of that cost must be paid for by other consumers in the amount they pay for gas. This is exactly what occurs under the old rate.

It is essential that our thousands of customers who use gas should be treated in the fairest manner, and their business retained and developed. We feel that this new schedule is a long step in the right direction.

Before making this change, we have studied the rate situation from all angles, investigating schedules of similar character by personal visits to several large cities of New England, where we found universal approval both on the part of the companies and public.

Catechism of Central Station Gas Engineering in the United States

Installment No. 13

(Continued from last week)

"As the contact between the gases and the heated surface of the retort and its contents is the principal cause bringing about decomposition of the gas and vapor inside the retort, and, seeing that the effect of the seal is to cause the gases and vapors, from their elastic nature, to pulsate violently backwards and forwards along the roof and sides of the retort, it is evident that the gases and vapors traveling along the roof of the retort will be caused by this pulsating action to travel again and again over the same surface, and thereby be made to undergo repeated decomposition, and, consequently, an extra amount of carbon must be deposited." To test the truth of the theory thus stated by him, Mr. Young, of Peebles, Scotland, experimented with a piston so that violent pulsations of the gas could be produced, and found that working under the same mean pressure and similar conditions as to heat, carbon deposited to a depth, in places, of ¾ in. during six charges under pulsation, while when pulsation was avoided the deposit during the same number of charges was scarcely noticeable.

Deposition of Carbon

The more carbon deposited, over and above a certain amount derived from the decompositions necessary to produce fixed gas from the heavier vapors evolved during the earlier portion of the distillation, the lower the illuminating value of the gas. Further, with an Anti-dip arrangement in use, there is, of course, no danger of the gas having to bubble through tar and thus lose illuminating value.

The increased length of life of the retorts is considered to be due to the fact that the existence of a steady pressure in the retort allows the pores of the fire clay to become thoroughly saturated with carbon which cements the particles of clay together, making the material stronger.

Argument Against Anti-Dips

It is argued against Anti-dips that as generally made they are very liable to get out of order from the deposition of tar and pitch on the valve faces and seats and on moving parts, thus causing more expense through breakage, loss of time and loss of gas by leakage than is saved by the removal of the seal; that unless automatic in action they require constant thought in order to prevent loss of gas or occurrence of accidents from neglect to manipulate them properly; that the passing of the gas through the liquid forming the seal to the dip-pipe is a necessary and valuable step in purification; and in general that when proper precautions are taken to prevent the accumulation of tar and to maintain an even, regular liquor seal, the hydraulic main and the dip-pipe are among the most simple and useful of gas works appliances, and there is no occasion for dispensing with them in favor of even the most approved form of Anti-dip.

There can be no question, however, that Anti-dip arrangements are employed with good results in many works, especially in Great Britain, and it seems as if on the whole the weight of evidence was in favor of their use when properly designed.

Coal "Liming" and Its Purpose

60. What is "coal liming"? Give its purpose and its effect on the impurities in the gas and on the residuals produced.

Ans. By "coal liming" is meant the mixing of a certain amount of slaked and powdered lime—usually about 3 per cent by weight—with the coal before it is charged into the retorts. Its purpose is to reduce the amount of work on the purifiers by retaining a portion of the sulphur in the retorts in combination with the lime, and also to increase the yield of ammonia. It has been stated by a good authority as the result of experiment, that the life of the purifying material is doubled, the amount of ammonia in the gas greatly increased, and the quantities of carbon monoxide and carbon dioxide notably diminished. The appearance of the coke, however, is marred by white specks of lime, the amount of clinker is increased, and the quality of the coke impaired by the increased content of sulphur. The Trustees are not aware that the "coal liming process' is in use at this date in any gas works.

Impurities in Gas

61. Name the chief impurities in crude coal gas as it leaves the retorts and give the reasons why they should be removed from the gas before it is distributed.

Ans. The chief impurities in crude coal gas as it comes from the retorts are: Tar, ammonia, NH_3, sulphuretted hydrogen, H_2S, and other sulphur compounds, and carbon dioxide, CO_2.

Tar should be removed by special appliances, since it is certain to condense when the gas cools, and unless it is completely and promptly separated from the gas while still hot it will absorb illuminants, thus reducing the candle power of the gas.

Ammonia should be removed on account of its corrosive action on brass and other metals employed in making meters and gas fixtures, on account of its pungent odor and on account of its marketable value.

Sulphuretted hydrogen and other sulphur compounds should be removed because if allowed to remain in the gas they will produce, when burned, sulphurous oxide, the substance formed by the combustion of sulphur, which is irritating to the lungs. Under favorable conditions the combustion of sulphuretted hydrogen may also form minute quantities of sulphuric acid. The amount of sulphur in gas as ordinarily purified, is too small to produce any appreciable effect.

Carbon dioxide is only harmful in so far as it reduces the illuminating value of the gas. The question of its removal or non-removal is usually decided by the comparative cost of such removal, and that of the extra enrichment required to overcome the loss of illuminating value.

Impurities Coming from Condenser

62. Name three or more impurities in coal gas, as it comes from the condenser.

Ans. "Ammonia, carbon dioxide and sulphur compounds."

Qualitative Tests for Impurities

63. Describe the ordinary qualitative tests for the presence in gas of tar, ammonia, NH_3, carbon dioxide, CO_2, and sulphuretted hydrogen, H_2S, and state at what points in the apparatus the test for each should be made in order to determine that the gas is being properly purified. Give your reason in each case.

Ans. The ordinary test for tar is made by allowing a jet of gas to impinge on a piece of white paper. If a dark stain appears on the paper, tar is present in the gas. A continuous test for tar can be made by passing a stream of gas through a glass tube filled loosely with cotton wool. If tar is present in the gas, even if only to a very small extent, the cotton will be discolored.

The test for ammonia is ordinarily made by allowing a jet of gas to impinge on moistened tumeric paper, the tumeric paper turning brown if ammonia is present in the gas. Litmus paper reddened by a weak acid can be used instead of turmeric paper and will regain its original blue color if ammonia is present. The turmeric paper is more commonly used.

Making the Various Test Papers

The following directions for preparing these papers are taken from Newbigging's Handbook:

"Turmeric Paper.—Six parts by weight of spirits of wine are added to one of turmeric powder in a stoppered bottle, and well shaken up occasionally for three days. A portion of the clear fluid is then poured on a plate, and pieces of unsized white filtering paper well soaked therein. These are then dried in air, cut into strips half an inch wide and two inches long, and kept for use in a bottle away from the light."

"Litmus Paper.—Six parts by weight of water to one of powdered litmus, shaken well together, allowed to stand for several days, and then filtered. Pieces of white filtering paper are then thoroughly soaked in the solution, dried, and cut into strips, which should be kept in a close stoppered bottle, excluded as much as possible from the air and light. Should it be desired to redden the solution, add (after filtration) a small quantity of very dilute sulphuric acid, gradually, drop by drop, until the pink or neutral tinge is obtained."

The test for carbon dioxide is made by allowing a small stream of gas to bubble through lime water. If carbon dioxide is present a white precipitate of carbonate of lime will be formed and the lime water will become cloudy owing to the diffusion of this precipitate throughout the liquid.

The test for sulphuretted hydrogen is made by allowing a jet of gas to impinge on a piece of white paper wet with a solution of acetate (sugar) of lead. The formation of a dark stain indicates the presence of sulphuretted hydrogen in the gas.

When the Tests Should Be Made

Since the object of all these tests is to determine whether or not the gas is being properly purified, the test for each substance should be made at the outlet of that piece of apparatus which is employed to remove the last traces of such substance from the gas. The proper place at which to test for tar is, therefore, the outlet of either the tar extractor or the condenser, according to which piece of apparatus is being used for the purpose of removing the tar. The test for ammonia should be made at the outlet of the last scrubber or the last washer, since any ammonia that escapes absorption in these vessels is lost so far as any return from it is concerned. The test for carbon dioxide and sulphuretted hydrogen should be made at that point in the series of purifiers at which it is desired that the purification should be complete. This is usually the outlet of the second box if three boxes are in use, and the outlet of the third box when four are being used.

Naphthalene and Its Properties

64. What is naphthalene? What are its physical properties, and how are the obstructions caused by it removed?

Ans. Naphthalene is a hydrocarbon formed in comparatively small quantity (about 13.15 lbs. per ton of ordinary English coal distilled in coal gas retorts, according to Mr. R. W. Irwin) during the distillation at high temperatures of carbonaceous substances, such as coal and petroleum. It has been claimed that naphthalene can be formed in the gas after it leaves the retorts and during distribution, but this view is generally held to be incorrect, and from the present knowledge of the subject it seems practically certain that all the naphthalene found either in coal gas or coal tar is produced during the distillation of coal in the retorts. The molecule of naphthalene is composed of 10 atoms of carbon and 8 atoms of hydrogen, its chemical symbol being $C_{10}H_8$.

It is a solid at ordinary temperatures and pressures, melts at a temperature of 176 deg. F. and boils

at about 430 deg. F. It will, however, exist in a state of vapor suspended in gas at temperatures far below even that at which it solidifies as long as the gas is not saturated with it. As soon as the point of saturation is reached, the vapor passes directly into the solid state in the form of very light, flaky, flat crystals, which occupy a large volume in proportion to their weight. It is this property which renders naphthalene so troublesome to the gas manufacturer, since though the weight contained in a given quantity of gas is small (about 0.15 lb. per 10,000 cubic feet of ordinary English coal gas, according to Mr. R. W. Irwin) the crystals occupy sufficient space to seriously obstruct the apparatus and pipes around the works and the services in which they are deposited through chilling of the gas.

Obstructions Caused by Naphthalene

Naphthalene obstructions in the apparatus and pipes at the works are usually removed either by flushing with hot water or by steaming, the former being preferable, since the steam merely melts the naphthalene, and unless it can escape from the pipe at once it may cool down again and solidify in another part of the apparatus, while the hot water acts not only by melting the naphthalene, but also by carrying it along, to a certain extent, in mechanical suspension. It is well to use the water in considerable volume in order to secure this latter effect.

Naphthalene is removed from service pipes and small mains by means of light naphtha, gasolene or kerosene, which is poured into and allowed to run through the pipes, dissolving the crystals and carrying the naphthalene in a liquid form back into the mains and the drips. Sometimes wood alcohol is used instead of naphtha or kerosene. If the obstruction is very light, it may be blown out of the service into the main by means of an air pump, or even by the lungs.

Naphthalene in the form of crystals, like water in the form of ice or snow, will pass from the solid state directly into that of vapor, and thus naphthalene that has been deposited in the pipes in quantities too small to cause trouble and render it necessary to clear it away will evaporate again and pass off with the gas when this reaches the deposit in an unsaturated condition. This same naphthalene may be redeposited farther along in the system if the temperature changes so as to bring the gas again to the point of saturation with naphthalene, and it is probable that some action of this kind has given rise to the theory that naphthalene can be formed during distribution in a gas which was free from it when it left the holders.

The Use and Action of the Hot Scrubber

65. Describe a hot scrubber, its use and action.

Ans. If the vapors of tar which are present in coal gas in the hydraulic main could be carried by the gas to the consumer's burner they would be valuable as illuminants, but this cannot be realized because they liquefy at ordinary temperatures and form tar. This liquid tar condensed from the gas, if allowed to cool in contact, or to travel, with the gas, will absorb from the gas other light hydrocarbon vapors, which form, when burnt, the most useful light givers. It is, therefore, important to separate these vapors of tar from the gas as quickly as possible, and while it is still hot, so that the maximum of light hydrocarbon vapors will be retained in the gas. This is accomplished by the hot scrubber. The gas and tarry vapors leave the hydraulic main at a high temperature (between 110 deg. and 150 deg. F.), and pass into the hot scrubber. The gas should leave the hot scrubber at as near the entering temperature as possible. The hot scrubber may act on the principle of separation by friction, in which case the scrubber will consist of a shell filled with coke or wooden grids; or it may act on the principle of straining through small orifices and striking baffle plates, one type of such apparatus being the P. & A. condenser, described in the answer to question No. 66.

A Description of a Tar Remover

6. Give a description, illustrated with sketches if necessary, of one or more forms of apparatus for removing heavy tar from gas, and state the position in the sequence of apparatus that should be occupied by the tar extractors, with your reason for such location.

Ans. One method of removing tar from hot gas is founded upon the principle that deposition of the vesicles of tar held in suspension in the gas may be effected by bringing these vesicles into contact with solid surfaces, or with each other. The Pelouze and Audouin condenser, founded upon this principle and designed for use with hot gas, is a very efficient and compact form of apparatus for the removal of heavy tar from gas.

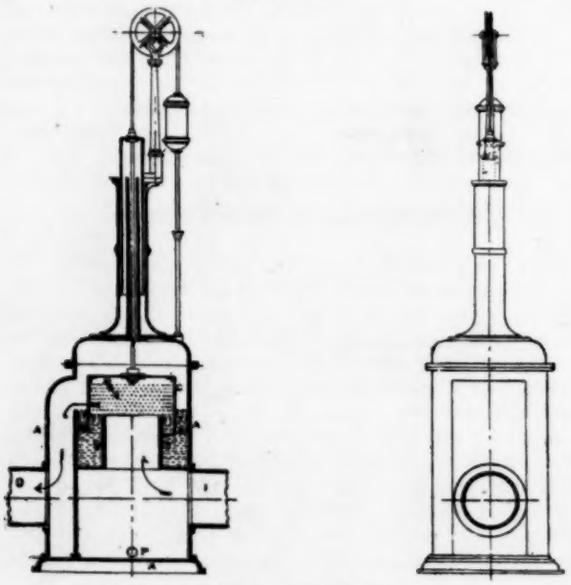
The action of the apparatus is as follows: The gas to be purified is made to flow through a series of holes of small diameter, so forming jets, which strike against a surface situated directly opposite. In the passage of the gas through the holes, the liquid molecules are brought into close contact with each other, and the operation is completed by the contact with the solid surface upon which the tarry matter is deposited.

The Construction of the Apparatus

The apparatus is represented in the cut, part shown a. broken away in order to explain more clearly its actions AAA is the outer case, to which are attached the inlet and outlet pipes, I and O. Concentric with the case is fixed an annular tank BB, in the middle of which is left a free passage for the gas. This annular tank is charged by preference with dead oil obtained from tar, and in it is suspended the bell or holder C, counterbalanced as represented.

The sides of the bell C for a portion of its height are formed of three or more concentric cylinders which are separated by a space of about three-eighths of an inch between them. Each cylinder is pierced, as represented at D, with a number of rows of holes each about one-twentieth of an inch in diam-

eter, which are so placed that the gas in passing through the orifices of one of the cylinders impinges against the plate of the next; by this means all the tarry vesicles are broken up in a manner so complete, that when the apparatus is dispensed with, a piece of writing paper being exposed to the influence of the gas issuing from a small jet is, in the course of two or three seconds, rendered almost black by the deposit of the tar; whereas, when the condenser is in operation under like conditions, the paper is not soiled in the slightest degree. The tar is deposited on the side of the bell, whence it passes off by a suitable opening to the pipe P.



P. AND A. CONDENSER.

The bell, being balanced and free to move as shown, rises and falls automatically as the difference between the pressure inside and that outside of it increases or decreases, and so by the exposing, as the conditions demand, of a greater or smaller number of holes through which the gas can pass the pressure thrown by the apparatus is kept constant in spite of variations in the amount of gas made. A pressure gauge should be provided to show when this governing action is being interfered with by the clogging of the holes in the bell. When this occurs the holes should be cleaned, and the apparatus is so designed as to permit such cleaning to be done.

Description of Dry Scrubber

A form of apparatus known either as a hot scrubber or a dry scrubber is also used for this purpose. It consists usually of a rectangular shell, enclosing a space which is divided into several compartments, the gas passing through these compartments in succession. In each compartment is a series of plates so arranged that the gas is frequently baffled and forced to change the direction of its travel, and is at the same time exposed to friction in passing over the surface of the plates. The shock of the impingement on the baffle plates, added to the friction between the gas and the plates, causes the deposition of the tar just as in the P. and A. condenser. As, however, the gas is not divided into small streams, as in the latter form of apparatus, the dry scrubber must be made much larger if it is to handle the same quantity of gas per day.

The heavy tar extractor should be so located in the sequence of apparatus as to receive and treat the gas before it has been cooled down below 100 deg. F. It may be placed after the exhauster when the gas leaves the latter at a temperature above 100 deg. F., but should be placed before the exhauster when the gas leaves the latter at a temperature below that point.

Reason for Location of Tar Extractor

The reason for so locating the tar extractor is that the heavy tar has, when cold, the property of absorbing from the gas the vapors of the lighter liquids, which vapors if not absorbed in this way would remain suspended in the gas. They are very efficient in adding to light-giving value of the gas, and if the tar is allowed to absorb them the illuminating value of the finished gas is made lower than it will be when they are kept in it. At a temperature above 100 deg. F. the tar does not seem to have any appreciable effect upon them, so if it is removed while the temperature is above that point it is prevented from exerting any harmful influence upon the illuminating value of the gas.

An ordinary tower scrubber filled with boards is used in carburetted water gas apparatus as a tar extractor, the boards being sometimes left dry, but usually wetted by a spray of water. In general, any form of washer may be used for the removal of heavy tar from the gas, provided hot ammoniacal liquor is employed as the liquid through which the gas is bubbled.

Advantages of Exhausters

67. Give one or more reasons why an exhauster is an advantage in a coal gas works.

Ans. "As the pressure in the retort can be reduced by the use of an exhauster, the amount of deposit of carbon in a solid state on the interior of the retort is lessened to a great extent, as the amount of deposit depends on the temperature and pressure to which the gas is exposed.

"The loss due to leakage is very much reduced, as a heavy back pressure would increase the loss.

"The amount of gas obtained is greater with the use of an exhauster than without it."

Speed of Coal Gas Exhauster

68. Should a coal gas exhauster be maintained at constant speed? If so, why? If not, why not?

Ans. No.

The speed of the coal gas exhauster should vary as the quantity of gas being made varies, in order that the pressure of gas in the retort may be constant.

(Fourteenth Installment Next Week)

CONSERVING THE HEAT IN COKE

(Continued from page 287)

exert any great influence on the efficiency of the cooling apparatus.

(In the original article a number of analyses of the gases are given. It was shown that the proportion of the various ingredients of the gases vary quite considerably. The analyses also indicated that there was a certain amount of hydrogen, varying from 0.4 to 18.4 per cent, present in the gases, and that the oxygen which was sucked into the apparatus in the form of air was partially consumed in burning up the hydrogen, which meant that less of the coke itself was consumed. The net conclusion reached is that only a comparatively small proportion of the recovered coke was burnt up by the air drawn into the cooling installation, and that practically all of the incandescent coke fed into the apparatus was recovered as such.—Editor.)

The Presence of Hydrogen Explained

The presence of the hydrogen in the gases is due to the fact that the retorts are discharged too soon and hence are not properly de-gased. A number of analyses of the circulating gases were made at different time intervals after the cooling chamber had been filled with incandescent coke. The analytical figures are given in the tabulation below:

Time interval after last charging with incandescent coke.	8m.	53m.	2h. 25m.
Carbon dioxide	7.3	10.9	13.9
Carbon monoxide	14.0	6.8	2.1
Oxygen	0.4	1.4	2.1
Methane	1.5	1.5	0.0
Hydrogen	8.9	1.9	0.1
Nitrogen	67.9	77.5	81.8

The analyses of the gas show a proportion of 14.3 per cent of oxygen combined with carbon after eight minutes, 14.3 per cent after 53 minutes and 15 per cent after 2 hours and 25 minutes. At the same time the percentage of free oxygen increases.

Conclusions on Operation of Installation

The final conclusion that can be drawn from the aforementioned figures and discussion is that due to the porosity of the walls of the installation and to the fact that the temperature varies in the cooling chamber, a certain amount of air is sucked into the apparatus and that this air may have the effect of causing the combustion of a small amount of the coke. However, this combustion loss is of no practical importance, as the temperature is not high enough in the cooling chamber or any other part of the installation to promote the same.

The Possibility of Explosion

A large number of analyses of the circulating gases, sixty in all, were made to see whether or not some definite conclusion could not be reached regarding the explosibility of the same. In this connection the oxygen, carbon monoxide and hydrogen contents of the gas are of particular significance. The proportion of oxygen in the gas is at all times small. Right after the incandescent coke is filled into the cooling chamber it is generally zero. It gradually increases and reaches a maximum towards the end of the night shift and at that time the maximum oxygen content of the gas was found to be 3.6 per cent. But by that time the installation has been pretty thoroughly cooled off and, furthermore, the gas contains the least amount of explosive constituents. There can be no danger whatsoever that the coal gas will explode when so small amount of oxygen is present in it.

Another question that has been raised is whether or not it is possible for an explosion to take place when the gas is mixed with a larger quantity of air.

The carbon monoxide content of the gases varies around 10 per cent. It may rise to quite a high percentage, to be sure, to a maximum of 19 per cent. The hydrogen content of the gas generally remains under 10 per cent. However, when badly-degasified coke is filled into the cooling chamber, it is possible that the percentage of free hydrogen in the gas may rise to as high as 19 per cent. In the most unfavorable case and under the most disadvantageous conditions, it is possible for a gas to be obtained that consists of a 40 per cent mixture of carbon monoxide and hydrogen. In other words, this may be considered as a sort of water gas. The remainder of the gaseous ingredients, that is, carbon dioxide and nitrogen, make up the other 60 per cent.

In the case of a mixture of water gas and air, the limits of explosibility at ordinary temperature lie between a proportion of 12.5 and 66.6 per cent of water gas in the mixtures. In other words, the carbon dioxide and the nitrogen contents of the gas must be replaced in quite a considerable degree by air in order to obtain an explosive mixture of the gas and air. Such a thing does not and cannot happen in practical operation of the cooling installation. It is much more possible that a further dilution of the gas takes place rather than the formation of an explosive gaseous mixture. However, even though there is no danger from this source, nevertheless care should be taken to see that the coke is properly de-gased in the chambers before it is introduced in the cooling chambers.

A Few Operating Figures

A few operating figures are given below which show in some degree what can be obtained when the heat in the coke is conserved instead of being allowed to go to waste as in the common way in which coke is cooled at the average gas works.

The superheat of the steam in the boiler was ten atmospheres. The cooling chamber capacity was six tons of coke every hour. The temperature of the feed water was 57 degrees C. The steam that was produced at 9.8 atmospheres superheat amounted to 467 kilograms per thousand kilograms of cooled coke. Over a long period of operation it was found that the quantity of steam produced was from 400 to 420 kilograms per ton of coke. The quantity of coke that was cooled during a period of sixteen hours was 61.8 tons, and the average temperature of the incandescent coke, as it entered the cooling chamber,

was determined to be 1092 degrees C. The average temperature of coke, as it left the cooling chamber, was 212 degrees C. The net efficiency of the cooling installation was estimated to be 80.2 per cent.

General Conclusions

From the experience that has been gained with this type of cooling installation in which the incandescent coke is cooled in the dry condition, it may be concluded that it is a very effective method of cooling. A considerable amount of steam is produced by the heat which is in the incandescent coke, which heat goes to waste under ordinary conditions. The final coke is absolutely dry and hence is more stable, less liable to fall to pieces, than the coke that is cooled by the wet method. The coke produced by the dry cooling is light gray in color, comes in large pieces and gives less breeze than when the coke is quenched with water. Furthermore, in dry cooling of coke there is none of the trouble of generation of steam and formation of dust that are experienced in wet quenching.

SELECTING THE BEST FUEL FOR COMMERCIAL COOKING

(Continued from page 292)

Often the use of a wrong type of gas burning equipment will impair the economic use of gas. The worst enemy of the use of gas is the man who uses gas inefficiently, who naturally becomes a dissatisfied customer. His gas bills are usually higher than they should be, and there is general dissatisfaction. On investigating this type of customer, we find the cause to be either inefficient operation, defect in equipment, or both. It is at this point that the sales engineer can do the customer a valuable service by studying his particular problem, finding the trouble, and recommending the most efficient and economical equipment for his purpose.

Flexibility Is Practical Requirement

The chef wants speed, plenty of heat and he may want it at any point and at a moment's notice.

The chef will not tolerate a reduction in speed, regardless of how much he is educated in the art of cooking. Although he knows that you cannot raise the temperature of a liquid over the boiling point and that 800 degrees Fahrenheit is more than enough to keep most liquids boiling, the chef wants to know that he has intense heat in reserve so that they can get 1,100 degrees Fahrenheit when he wants it.

I saw a chef working on the top of a closed top gas range, which was about 1,000 degrees Fahrenheit. He pulled the cover off the range and put a stock pot filled with peeled potatoes immersed in cold water. I asked him if the top of the range was not hot enough. He informed me that in boiling vegetables of any kind the greater the speed, the better the taste, and the more nourishment is retained in the vegetable. He, therefore, put the stock pot in direct contact with the gas flame, which was about 1,600 degrees Fahrenheit. In preparing soup stock this same chef used about 400 degrees Fahrenheit, and for fry work he would use a medium heat.

Advantages of Gas Over Coal

In considering the advantages of gas over coal as a fuel, with reference to flexibility, we note that a gas kitchen is never subject to delay due to the necessity of making up the fire. The fire is always ready, and does not require any stoking. The cooks are never compelled to stand aside to permit the fireman to stoke the fire.

The ovens are always available, giving any temperature necessary.

There is more hot surface available on the gas range than on a coal range.

A chef can do better work with gas equipment than with coal, because the fire is under perfect control, and any required temperature can be obtained at any time, no matter which way the wind blows.

Better toast can be made with gas because the fire is under perfect control. The fire being above, the condition of the toast can be watched more closely. There is no reason for turning over until completely toasted on one side.

Salamandering cannot be done at all with coal. This process requires top heat.

We also claim that gas ranges save 20 per cent space, that eight cooks can work on gas equipment where only six can work on coal. We believe that forty inches is the space required for one cook. A coal range, owing to the necessity for fire box, cannot be built in less than forty-eight inches, which means only one cook to a fire. The space occupied by a man is eight inches too much, or 20 per cent.

Gas With Reference to Hygiene

Any kitchen on account of cooking fumes, need at least six changes of air per hour; the fact is, most kitchen ventilating systems are designed for ten changes per hour.

All medical authorities agree that the air may contain 3 per cent carbon dioxide without any injurious effect on animal life.

Let us consider the number of cubic feet of gas an hour that may be burned in a kitchen 10x20x10 feet without any ill effects on those working in the kitchen. Cubical contents of the room is 2,000 cu. ft.

Two thousand times 6 equals 12,000 cubic feet of fresh air an hour. Each person exhales .8 cubic foot of carbon dioxide per hour.

Assume that there are ten people in the kitchen. Then eight cubic feet of carbon dioxide per hour is present, due to respiration.

From analysis of Chicago gas, we find that after complete combustion for every 100 cubic feet of gas we get 46.4 cubic feet of carbon dioxide.

The permissible carbon dioxide per hour in the above case would be 12,000 $\times$ .03, or 360 cubic feet less 8, due to respiration, is equal to 352 cubic feet that may be due to gas.

$$\frac{352}{46.4} \times 100 = 758$$

cubic feet of gas per hour, permissible to burn before any injurious effect will occur, and that is assuming that there is no flue connection for the gas burning equipment.

Seven hundred and fifty-eight cubic feet will operate three heavy duty hotel ranges, and a broiler, that

is, sufficient gas burning cooking equipment to feed 1,000 people with 10 help added, will not give off enough carbon dioxide gas to cause injury to health.

If there are flue connections to the gas burning equipment, both the cooking fumes and the carbon dioxide are carried out and there are absolutely no ill effects.

Of course, if suicide is intended, our slogan, "You can do it better with gas," holds true.

Ventilation Is Stimulated

Medical authorities advise us that carbon dioxide in itself is of no harm, but in respiration it often carries disease germs. Milk, one of our principal foods, is also a germ carrier. We kill the germs by sterilizing the milk. Carbon dioxide, due to the combustion of gas, is from its nature necessarily sterile.

The use of gas for cooking, due to its intense localized heat, in connection with the flue, will stimulate ventilation.

When considering coal with reference to hygiene, we must consider that the entire kitchen can be kept cleaner when gas is used, because there is no dust or ashes flying about.

It is evident that the attempts of the electrical interests to scare us with the carbon dioxide boogy man should have no effect.

We may safely conclude that gas is a hygienic fuel for commercial cooking.

Conclusion

We have considered the three available cooking fuels, with which we come in contact in Chicago, namely, gas, coal and electricity.

We come to the conclusion that coal as a fuel for commercial cooking is fast becoming only a memoir, and that electricity is in its experimental stage, inherently the wrong kind of a fuel to use, and up to the present date has proven a failure.

We have agreed upon the essentials of an ideal fuel for commercial cooking, and have measured each fuel against this ideal and found that gas would conserve our natural resources; that gas is the most reliable fuel, that gas is unquestionably the most economical, that in filling the practical requirements of flexibility, gas is without a peer and that gas is a hygienic fuel.

It is obvious that gas as a cooking fuel not only approaches the ideal, but is, as it always has been, the ideal fuel for commercial cooking.

Human nature has a tendency to accept as true anything that has not been proven as untrue. The electrical fanatics are doing everything in their power to hoodwink the electric power companies into believing that the cooking load is very desirable and the commercial cookers into believing that it is a convenient fuel.

It is up to us who are interested in the gas industry, for the safety of the future generation and the present consumer, to propagate the use of gas as a cooking fuel.

It is the duty of everyone interested in the cooking industry to explain and demonstrate the use of gas as a cooking fuel, so that no one will be misled into thinking that they can cook by radio or some other wire or wireless device.

PROVIDENCE GAS CO. CELEBRATES 75TH ANNIVERSARY

Reports were submitted and officers elected at the annual meeting of the Providence Gas Company, which observed recently the 75th anniversary of its founding, and incidentally the close of a 75-year period in which gas from its stations has not ceased flowing for a minute.

Officers re-elected are: President, Charles H. Manchester; vice-president, Henry D. Sharpe; vice-president and engineer, Frederick C. Freeman; secretary and treasurer, Arthur F. Short; assistant treasurer, Augustus W. Bourne.

Directors re-elected are: Henry D. Sharpe, Webster Knight, Frank W. Matteson, William L. Hodgman, John B. Branch, Charles H. Manchester, John O. Ames, James R. MacColl, Frederick S. Peck, Florrimon M. Howe and William G. Roelker.

An increase of 9.5 per cent in the output of gas for the year 1923 was shown in the annual report of the company. Net income for the year was $943,174, equal to $5.12 a share on the outstanding stock. The net income in 1922 was $961,315, or $5.22 per share. Higher operating costs were named in the report as the cause of the slight falling off in income. After payment of dividends of 8 per cent, $206,698 was carried to surplus, bringing that account up to $650,189.

President's Report

The total send-out of gas for the year ended December 31, 1923, was 2,784,540,000 cubic feet, compared with 2,542,325,000 cubic feet in 1922. Each month in 1923 except December showed an increase over the corresponding month in 1922, varying from 25.4 per cent in February to .3 per cent in September. December, because of the abnormally high temperature, showed a decrease of 3.4 per cent. The send-out in October was 255,544,000 cubic feet,

NEW YORK PUBLIC LIBRARY WISHES BACK NUMBERS OF AMERICAN GAS JOURNAL

We quote the following from a letter received from the director of the New York Public Library:

"We receive at the library regular issues of your publication entitled the American Gas Journal, and the magazine has been found of much interest. We lack a number of issues, however, and as it is our intention to preserve these files permanently, we feel that it is most important that they should be complete. We write, therefore, on behalf of the library to ask if you will be so kind as to send us copies of the numbers needed, which are as follows:

"Vols. 34 to 43, all issues; Vol. 43, Nos. 1 to 6, 13 to end of volume; Vol. 45, Nos. 3, 5, 13 to end of volume; Vol. 46, Nos. 1, 6, 10, 13, to end of volume; Vol. 47, Nos. 1, 3, 5, 6, 8, 12, to end of volume; Vol. 48, Nos. 1, 2, 4, 5, 13, to end of volume; Vol. 49, Nos. 4, 5, 13; Vol. 50, Nos. 3, 12; Vol. 51, Nos. 9, 16, 18, 19; Vol. 53, No. 17."

We only have these numbers in single bound volumes in our library. If any of the subscribers to the American Gas Journal have these old numbers, and are willing to part with them, we will be glad to purchase the copies and present them to the New York Public Library.

Current Market Prices

COALS (By Courtesy of Coal Age)

A. Bituminous.

(Spot prices, F. O. B., mines, net tons).

High Volatile, Eastern	Market	Price
Pool 54-64 (Gas Standard))	New York	$1.40 to $1.65
Pittsburgh screened gas	Pittsburgh	2.50 to 2.65
Pittsburgh gas, mine run	Pittsburg	2.25 to 2.35
Kanawha lump	Columbus	2.40 to 2.70
Kanawha mine run	Columbus	1.45 to 1.70
West Virginia lump	Cincinnati	2.25 to 2.75
W. Virginia gas mine run	Cincinnati	1.15 to 1.50
Midwest		
Indiana 4th vein lump	Chicago	2.75 to 3.00
Indiana 4th vein mine run	Chicago	2.25 to 2.50
South and Southwest		
Big Seam lump	Birmingham	2.50 to 2.75
Big Seam mine run	Birmingham	1.75 to 2.25
Southeast Kentucky lump	Louisville	2.75 to 3.00
Southeast Kentucky mine run	Louisville	1.40 to 1.85

B. Anthracite.

(Spot prices F. O. B. mines, gross tons),

Market	Freight rates	Independent	Company
Egg New York	$2.34	$7.75 to $8.25	$8.75 to $9.25
Egg Philadelphia	2.39	8.50 to 10.00	8.75 to 9.25
Egg Chicago (net tons)	5.06	7.50 to 8.80	8.00 to 8.35

COKE (By Courtesy of Iron Trade Review).

Connellsville, furnace	$4.00 to $4.40
Wise County, furnace	4.50 to 5.00
Alabama, furnace	5.00 to 6.00
Foundry, Newark, N. J., del.	10.91
Foundry, Chicago, ovens	12.50
Foundry, Boston, delivered	12.50
Foundry, St. Louis	12.50
Foundry, Granite City, Ill.	12.50
Foundry, Alabama	5.00 to 6.50

PETROLEUM (By Courtesy of Oil, Paint & Drug Reporter)

(Prices at wells, per bbl.)

Pennsylvania—Ohio—West Virginia.	
Cabell, West Virginia	$2.20
Corning, Ohio	2.15
Lima	2.28
Pennsylvania	4.00 to 4.50
Wooster, Ohio	2.15
Indiana—Illinois.	
Illinois	2.07
Indiana	2.08
Oklahoma—Kansas.	
Healdton	.90
Mid-continent (low gravity)	1.00
Gulf Coast.	
Gulf Coast, Grade A	$1.80
Gulf Coast, Grade B	1.50

GAS OILS.

Gas Oil, Bayonne, bulk gal.	5½c
Gas Oil (32-36) Illinois-Indiana, gal.	5.75 to 6.00c
Gas Oil (32-36) Oklahoma, gal.	3¼ to 3½c
Gas Oil (32-36) Gulf Coast, gal.	4½ to 5 c

PIPE AND FITTINGS—CAST IRON GAS PIPE.

(By Courtesy Iron Trade Review.)

Four-inch, Chicago	$66.20 to $67.20
Six-inch and over, Chicago	62.20 to 63.20
Four-inch, Birmingham	57.00 to 58.00
Six-inch and over, Birmingham	53.00 to 54.00
Four-inch, New York	70.60 to 71.60
Six-inch and over, New York	65.60 to 66.60
Standard fittings, Birmingham, base	115.00

6 to 24-inch, base; over 24-inch, plus $20; 4-inch, plus $20; 3-inch, plus $20.

BY-PRODUCTS

(By Courtesy of Oil, Paint and Drug Reporter)

Ammonia aqua, 16 deg. drums lb.	5 to 5¼c
Ammonia aqua, 20 deg. drums lb.	6¼ to 6½c
Ammonia aqua, 26 deg. drums lb.	6¾ to 7 c
Ammonia squa, anhydrous cylinder, lb.	30 to 36 c
Ammonium sulphate, bulk F. O. B. Works, per 100 lbs.	$2.85 to $2.95
Potash prussiate, yellow casks, lb.	19 to 20 c
Potash prussiate, red casks, lb.	42 to 45 c
Soda prussiate, yellow casks, lb.	13 to 13½c
Soda sulphocyanide, barrels, lb.	45 to 55 c

COAL TAR BASIC PRODUCTS.

(By Courtesy of Oil, Paint and Drug Reporter)

Benzol C. P. tanks, works, gal.	25 to 30c
Benzol, drums, gal.	30 to 35c
Benzol, 90% tanks, works, gal.	23 to 28c
Benzol, 90% drums, gal.	28 to 33c
Napthalene, flake, barrels, lb.	6¼ to 7c
Napthalene, crushed bags, lb.	5½ to 6c
Solvent Naphtha, water white works, gal.	28c
Solvent Naphtha, drums, works, gal.	33c
Solvent Naptha, Crude Tanks, works, gal.	25c
Solvent Naphtha, drums, works, gal.	30c
Toluene, C. P. tanks, works, gal.	31c
Toluene C. P. drums, works, gal.	36c

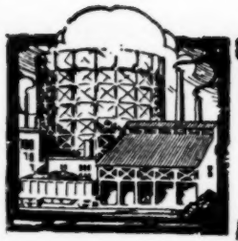
Buying is confined mostly to domestic business, where consumers have been buying from hand to mouth for some time. Large consumers continue to place dependence to a large extent upon stock piles, confident that they have nothing to lose—perhaps something to gain—by waiting to see what April 1 will bring forth. Continued price adjustments seem to justify the policy.

Another cloud in the industrial sky has been cleared away, an agreement having been reached between the Northern West Virginia Coal Operators Association and the union mine workers after a conference at Baltimore lasting ten days. Wyoming also signed up. Union representatives of the Central Pennsylvania field wound up their meeting at Altoona last week with the adoption of a recommendation to seek the best scale obtainable for three years at a conference to be held with the operators in Philadelphia this week.

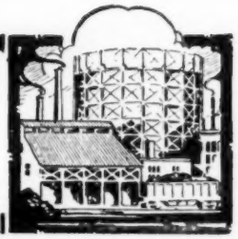
Crude oil, or rather the renewed decline in its production in practically every section of the United States, continues to hold the center of the stage in the petroleum market, and in some quarters at least is causing considerable concern, in view of its effect on the output and price of gasoline just as the season for that commodity is opening.

Owing to the fact that much of the gas oil business is done under contract, there is little demand in the spot market. In fact, some of the refiners are not even separating the gas from the run of fuel oil.

Production of gas and fuel oil at the end of January was 25,306,962 barrels, compared with 25,555,644 in December.



NEWS OF THE GAS INDUSTRY



F. A. Woodhead Talks to Employees' Association of Leominster Gas & Electric Co.

The March meeting of the Employees' Association of the Leominster Gas & Electric Company was held on March 20. The speaker of the evening was F. A. Woodhead, governor of the Gas Sales Association, whose subject was "Five Essentials for Every Utility Employee." In his talk Mr. Woodhead said:

"There are quite a few valuable factors which every employee of a utility should recognize in his duty of rendering service to the customer. Some authorities lay stress on certain things which are considered essentials, while others believe that entirely different things are essentials for the guidance of every utility employee.

"It has been my experience that, while there are quite a few different essentials which every employee should understand and practice, yet there are five essentials for every utility employee, which are not given the importance they deserve, yet place the utility through the employee, either favorably or unfavorably, before the public. These five essentials are: First, self confidence; second, lack of super sensitiveness; third, ability to make and hold friendships; fourth, willingness to do small jobs properly; fifth, personality.

"The one of self-confidence is evidenced every day in every walk of life. Success is not dependent on self-confidence alone, but on the confidence of others in us, although that is largely a reflection of our own confidence. Self-confidence is contagious. It affects every one with whom we come in contact, whether as office clerk, complaint clerk, meter reader, salesman, street foreman or whatever position we occupy, which brings us in contact with the public.

"If we adopt or acquire self-confidence, we shall be surprised how quickly it affects others by increasing their confidence in our ability to do the work that we start out to do. The world likes to see a man who knows what he is about to do. They give way for him. They will boost him if he is going up and kick him if he is going down. A person with average ability and self-confidence can accomplish more than one with ten times the ability and less self-confidence.

"This may appear to be unfair and unjust, but we must take conditions as they are and find the solution for ourselves. The solution is for the person without self-confidence to acquire it because the world is so busy with their own problems that they have not time to inquire as to what we know unless we show it by our outward actions. When a doctor calls upon us, we do not ask him to prove to us by a display of certificates that he has passed certain examinations. We have faith in his self-confidence that he knows how to treat our physical ills.

"The faculty of self-confidence is demonstrated in no better way than in the art of salesmanship, whereby a confident salesman in approaching a customer who comes into our salesroom to select some gas appliance, without any particular appliance in mind, is quickly led to a conclusion and decision by the confident air and apparent knowledge of the salesman with the quality of self-confidence.

"The same thing applies to foremen in the street, fitters or electricians in the customers' homes, meter readers reading meters, salesmen selling gas and electrical appliances and all employees of the utilities, whose very manner either creates a favorable or unfavorable impression of their ability by the very manner in which they go at their work.

"In considering the second thing we shall explain super-sensitiveness by saying that of all the sensitive persons you know there is one outstanding case of sensitiveness and which person is the most sensitive person you know. They are super-sensitive and are sensitive almost to the point of its being a disease. A great many employees of utilities are super-sensitive. They resent any criticism through their superiors and are easily discouraged or made angry by such criticisms. They resent criticisms through customers and they take these criticisms as a personal affront. They imagine that rulings by a company are aimed directly at them and resent such rulings. They do not take kindly to any changes suggested in their work which would lead to better efficiency. On the whole, they are jealous of their ability and actions and do not want anybody to criticise or suggest a change. Instead of taking such criticisms as constructive suggestions and improving their actions or instead of accepting any suggestions which would improve their work, knowledge and value to the company, they openly disregard such suggestions and finally place themselves where the employer feels it is a waste of time to spend any more effort upon them.

"They wonder why they do not advance and cannot see that through their own super-sensitiveness they are hindering their own progress. Hawthorne was a super-sensitive man and was so shy and sensitive that when he met an acquaintance coming up the street he would cross upon the other side in order to avoid the ordeal of meet-

ing that acquaintance. He always regretted that failing but could not seem to overcome it. Employees who have this failing are continually making trouble for themselves with their immediate superiors or with the customers of the utility because the factor of supersensitiveness is usually accompanied by a quick temper."

Taking up the third point, Mr. Woodhead said:

"Every employee of a utility should make and hold friendships not only with the employees of the utility but with the customers of the utility. Every man desires to be held in good esteem by his neighbors and friends.

"It goes without saying that a man is not going to give up a certain amount of independence in order to be well thought of, but it is a fact that a man does not stand unfavorable criticisms, if they are just, without a certain amount of pain or regret, because he feels it is a reflection upon himself and regrets that his friends should thus know of his just criticism.

"It goes without saying that the utility whose employees can make and keep friends has a valuable number of assets working night and day in the interests of the company. The company can be well thought of or otherwise through the influence of its employees in the community and its influence can be felt only by the friendly relations of the employees with the customers, thereby creating a friendly relation between the utility and the customer."

Taking up the fourth point, Mr. Woodhead said:

"Willingness of every employee to do small jobs is not always apparent. There is no intentional desire to avoid doing necessary work, but all of us feel that the larger things need our attention and that the smaller jobs can be slighted perhaps. Small things which are overlooked may be the taking of a telephone message and transferring it correctly or incorrectly; the making out of an order, giving the name completely and correctly and thereby avoiding possible errors; the installation of a gas appliance and the complete or incomplete adjustment of that appliance so that there will be no later complaint, and many other small tasks which the employee meets in the routine of a day's work.

"The big task he feels must be done, but he has a certain disregard for the effect created by continually making errors by not doing the small jobs completely and correctly. It is a valuable employee who can recognize that criticisms result from incomplete records or the leaving undone the small things in any work with which he might be connected and that these criticisms reflect back upon the company by the ill-will of the customer."

Touching on the fifth point, Mr. Woodhead said:

"In approaching the last topic of personality, the speaker is led to remark that personality does not cover entirely the mere personal appearance of the employee, but his whole manner and attitude with the customer. The matter of personality of the utility employee has grown to be a very important factor. The personality of the employee consists of not only his personal appearance, but his manner, his make-up, his cheerfulness and his whole bearing in the community in which he lives.

"In every office the popular person is the cheerful person. In every utility the popular person is the cheerful person.

"We all can recall when we were sick that we felt better immediately when the doctor came into the room. Some physicians appear to have a personality that seems to change your whole viewpoint when you are lying ill. They make us feel better before they have given us any medicine. It is simply the mere fact of personality which is just as important with the utility employee as it is with the physician. It does not matter how humble the position of the utility employee who can acquire a personality which will help him and help the utility with the customer. He can be cheerful, he can be agreeable, he can do his work properly and avoid criticisms.

"We can almost determine the personality of an employee by a telephone conversation and certainly can see the value of personality of the employee at the complaint desk. Summed up in a few words, personality includes cheerfulness, includes self-confidence. It has no place for super-sensitiveness. It values friends and friendships. It recognizes ambition to succeed. It tries to do the job assigned in the best way possible to the satisfaction of the utility and the customer. Let us all try to acquire it because, once acquired, it becomes, like courtesy, a part of our nature."

New Officers of Guild of Gas Managers Elected

Boston, Mass.—At the annual meeting of the Guild of Gas Managers, held in Boston, March 8, the following officers were elected for years 1924 and 1925: President, Clifford E. Paige, Boston, Mass.; vice-president, Charles R. Prichard, Lowell, Mass.; secretary, Francis E. Drake, Lynn, Mass.; treasurer, W. F. Norton, Nashua, N. H.

Camden, Ark., Gas Co. Sold

Camden, Arkansas—The Monie-Dunbar Construction Company of St. Louis, Mo., has purchased the Camden Gas Company from L. A. Porter and A. C. Gallivan. The Monie-Dunbar interests were granted the gas franchise for the city of Camden several weeks ago, when the Camden Gas Company failed to fulfill a similar contract.

The purchase of the Camden Gas Company gives the Monie-Dunbar Company complete control of the local gas situation. Work of completing the mains within the city will be started immediately, according to George L. Dunbar of the construction company.

A contract for the gas has been made with the Houston Oil Company of Texas, and that company is now making preparation for the laying of a main from its refinery at Herbert, two miles south of the city, to the fields. Gas is expected to be ready for Camden consumers by May 1.

Offers More Stock to Buying Public

Visalia, Cal.—The Central Counties Gas Company, serving Visalia, Exeter, Lindsay, Porterville and Tulare, has just asked the State Railroad Commission for permission to sell 100,000 shares of its preferred and common stock of a par value of $1 per share and at a price of not less than 92½ cents. The stock will be placed upon the market for extensions and improvements to the system.

Gas Company Deal Consummated

Dayton, Ohio — The deal by which the Dayton Gas Company in its entirety became the property of the Columbia Gas & Electric Company of Cincinnati, has been consummated with the payment of the purchase money, according to word received from officers of the Pure Oil Company at Columbus.

The Pure Oil Company owned the Dayton Gas Company, the Springfield Gas Company, the Federal Gas Company of Columbus and the Columbus Gas & Fuel Company. All of the assets of these four concerns were sold to the Columbia Gas & Electric Company of Cincinnati for about $13,000,000.

The purchasing concern is expected to supply Dayton with gas as soon as the contract now in force with the Logan Gas Company, the present supply company, expires in June, 1926. The Columbia system operates extensive gas fields in West Virginia. It supplies Cincinnati with gas and electric current.

New Heating Rate for Gas Is Filed by Company

Tacoma, Wash.—Before the Department of Public Works at Olympia recently the Tacoma Gas Company filed a supplemental tariff which will be offered to Tacoma consumers as an optional rate for house heating, which involves an entirely new theory of gas rate making.

Vice-President and General Manager D. J. Young said it is difficult to say what the reduction will be, but in some cases he thought it will amount to 15 per cent. He admitted that for some small consumers it might show a small increase. Acceptance of the new rate plan is optional with patrons, however.

The principle of measurement used in electric rate making is to be utilized in the new rates. There will be a straight customer charge of 50 cents for each customer per month. Then there will be a demand charge of 3 cents a cubic foot on the maximum demand per hour of the user and a third charge of 55 cents per thousand cubic feet for the gas consumed. The minimum demand charge will be 100 feet or $3. The stated demand cannot be exceeded, for automatic meters will shut off when the limit is reached.

Manager Young declared that under this three-way rate for an average five or six-room cottage, the total gas cost should be about $50 for customer charge, $4.50 for demand charge on a maximum demand of 150 cubic feet per hour, and a charge of $8.25 for 15,000 cubic feet of gas at 55 cents. This would take care of all heating, cooking and hot water heating in the home at a total of $13.25.

The company is going to guarantee consumers this first year to get them to using the new optional rate plan, Manager Young admitting that he hopes in time to make the plan general and applicable to all consumers in the city. It is admitted its application now, however, to many small consumers would increase their bills, but the whole purpose is to increase the use of gas.

Manager Young has invested and the company is now constructing a new gas plant at an expenditure of $350,000 here, which will be a new departure in gas making and reduce costs. In order to cover the new overhead due to the extra investment, however, it is essential to extend the use of gas in the city and the heating business is to be emphasized in the future. The new plant will be put in operation about August 1, it is expected.

The 16th annual meeting of the S. G. A. will be held at the Bon-Air Vanderbilt Hotel, Augusta, Ga., Tuesday, April 22, Wednesday, April 23, and Thursday, April 24, 1924.

New Water Gas Apparatus to Be Installed at Bristol

The Charles H. Tenney Company of Boston, which operates the Bristol and Plainville Electric Company at Bristol, Conn., has awarded to the U. G. I. Contracting Company of Philadelphia contract for the installation of cone top carburetted water gas apparatus capable of increasing the plant capacity by approximately 2,300,000 cubic feet.

With this additional equipment the Bristol Company will be well equipped to handle the additional consumption of this territory.

Company Plans Big Extension

Plans for 1924 are being made by the Fulton County Gas and Electric Co., Gloversville, N. Y., for extensive improvements at an estimated cost of $223,700, according to an announcement made recently by Manager L. C. Smith. It is expected that work will be started in a few weeks.

At the gas plant there will be constructed the 150,000 gallon additional oil storage tank to insure the continuity of gas service for a longer period of time in case of railroad strikes or congestion during the winter months. There will also be installed a system of hydraulic control of the two gas sets which will greatly facilitate the operation of these machines.

The new 150 H. P. steam boiler with an 175 per cent rating will replace one of the oil boilers now installed.

These improvements at the gas plant, including other small miscellaneous items, will cost $38,500. Distribution improvements, including new mains and enlargements of old mains ahead of permanent paving, will cost $21,500.

A number of miscellaneous distribution improvements are contemplated in the various communities served by the Fulton County Gas and Electric Company, which represent an expenditure of $14,500.

The Twin States Gas & Electric Company, Brattlevoro, Vt., has added a new $8,000 stucco garage to its equipment.

Northern Indiana Gas Co. Buys Elkhart Gas Interests

Elkhart, Ind.—Sale of the Elkhart Gas and Fuel Company to interests connected with the Northern Indiana Gas and Electric Company was consummated recently and announced at the office of the Elkhart concern. Morse Dellplain of Hammond becomes president of the Elkhart company and G. M. Johnson of South Bend vice-president. The Elkhart property was purchased from the American Public Utilities Company, which is the holding company of the Kelsey-Brewer interests with headquarters at Grand Rapids, Mich. Total assets of the Elkhart company aggregate a little over $1,500,000, officials here say. Its 1923 sales totaled 180,000,000 cubic feet of gas. The Northern Indiana Gas and Electric Company now operates plants in twenty cities.

N. J. Public Service Plans Readjustment

The Public Service Corporation of New Jersey announces a plan for readjusting its capital structure and make the procurement of additional capital for expansion easier. The most important step will be the consolidation of the Public Service Electric Company, the Public Service Gas Company, the United Electric Company of New Jersey and several smaller companies into a new concern, to be known as the Public Service Electric and Gas Company, all of whose common stock is to be held by the Public Service Corporation.

To make this possible the $19,736,800 common stock of the United Electric Company will be converted into an equivalent amount of 6 per cent preferred stock of the Public Service Electric and Gas Company as pledge for the perpetual interest bearing certificates. The holders of the 5 per cent bonds of the Public Service Corporation will be offered in exchange 5½ per cent bonds of the Public Service Electric and Gas Company under a new mortgage, while the 7 per cent bonds are to be redeemed. Further consolidation through security interchanges with other leased subsidiaries is also proposed.

The plan is set forth at length in a letter mailed to stockholders recently. It also involves the floating before long of about $18,500,000 of bonds by the parent company to meet the maturity of 7 per cent bonds and fund floating indebtedness.

To Reopen Atlanta Gas Case

Atlanta, Ga.—"The whole purpose of the present gas case," said H. M. Atkinson, of the Georgia Railway and Power Company, in reopening the case of the power company against the Georgia Public Service Commission before Master in Chancery Cam Dorsey here today, "is to get a just valuation of the gas company's property, and to establish a fair method of determining value so in the future investors may feel safe and be ready to supply additional money in order to provide for proper extensions and improvements of the property and meet the needs of a rapidly growing city.

"The question is not one of rates, but of establishing a fair method of determining value on which to base rates.

"This is necessary if the service Atlanta should have is to be provided in the future. If we can't get some proper legal rule as to the true value, investors will never know where they stand.

"The return on the investment should equal double the bond interest. The investor must feel that he has adequate security before he will part with his money. It will take $10,000,000 of new cash capital to provide gas service equal to that at present given for an Atlanta of 500,000 population.

"Who will put up this $10,000,000 unless there is a sufficient margin of earnings to attract the investor and insure proper security for him?

"The gas company has been furnishing service since 1856—nearly 70 years. The name of the company has always been synonymous with good service. The entire period up to the World War was one continuous record of reduced rates. For many years we sold gas at $1 per thousand cubic feet.

"The war came on, and the price of everything except gas soared. We went to the state, gave definite figures of increased costs and asked for rates to equalize this increase. We lost. Prices kept going up, so we went to the state a second time and secured an increase of 30 cents in the price of gas after the cost of making this gas had increased 140 per cent.

"In 1920 the company failed to earn the out-of-pocket cost of producing gas by $60,827.88. In the past four years the gas company has lost nearly a million dollars."

The gas company has gone back to the original petition and is asking an increase in gas rates of from $1.55 to $1.65 per 1,000 cubic feet, and the case may have to be fought all over again to get a final decision in the matter.

Sixteenth Annual Meeting of the Pennsylvania Gas Association, April 9th and 10th

The annual meeting of the Pennsylvania Gas Association will be held in connection with the Eastern States Gas Conference, in Philadelphia, on April 9 and 10, at the Bellevue-Stratford Hotel.

We understand that an exceptionally excellent program is contemplated and the members of the various committees in charge of the meeting are working hard to exceed the wonderful meeting held last year.

Inasmuch as there will only be two days of meeting this year, the executive committee of the Pennsylvania Gas Association has decided to hold only a business meeting and luncheon at the same hotel on Wednesday, April 9, at 12:30 o'clock.

Complete announcements giving further particulars will soon be issued.

Contract Awarded

The U. G. I. Contracting Company of Philadelphia has been awarded contract by the Fulton County Gas & Electric Company, Gloversville, N. Y., to install a complete 125 horse-power horizontal return tubular boiler, together with auxiliary apparatus.

The U. G. I. also has orders from this company to install a 150,000 gal. oil storage tank, as well as complete hydraulic operating equipment for two 6 in. carburetted water gas sets.